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The Effects of Drug Subsidies on Out-of-Pocket Prescription Drug Expenditures by Seniors: Regional Evidence from Canada[*]

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Abstract: Between 1970 and 1986 all Canadian provinces introduced some version of a prescription drug subsidy for those age 65 or over and since 1986, all the provinces have increased copayments or deductibles to some degree. Employing a first-order approximation to the welfare gains from a subsidy, we find evidence that these subsidies have been less redistributive than an absolute per household cash transfer but slightly more redistributive than a transfer that would increase each household's income by the same percentage. Such evidence may have relevance for predicting the redistributive effects of a potential national prescription drug plan for seniors in the United States.

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1. Introduction

Both major political parties in the United States are reported as developing proposals for publicly funded and provided prescription drug programs for seniors (Toner, 1999). The National Academy of Social Insurance examined a variety of alternatives with various coverage, deductible, co-payment, maximum and stop-loss provisions and estimated costs as ranging from US$17 billion to US$24 billion, roughly 10 per cent of existing Medicare costs and approximately one-third of a per cent of GDP (Gluck, 1999).[1] In this study we try to evaluate some of the redistributive aspects of a public drug plan for seniors by examining the effects on out-of-pocket expenditures of such drug plans in Canada. Between 1970 and 1986, all Canadian provinces introduced subsidy programs for prescription drug use by those age 65 and over and have continued to adjust these programs to the present time. Table 1 summarizes

[1]United States Medicare is a federal program which provides some medical services to seniors, the disabled and patients with end-stage renal disease. In arguing for a U.S. prescription drug plan for Medicare enrollees, Soumerai and Ross-Degnan (1999) cite research that finds only 56 percent of Medicare beneficiaries had some prescription drug coverage in 1997, with that provided through private employers, private insurance to supplement Medicare, Medicaid (another federal program that provides medical care for the indigent) or Medicare Health Maintenance Organizations (HMOs). They also cite research outlining gaps in these kinds of coverages. For example, Medicare HMO drug coverage is typically subject to annual caps of as low as US$600 and the clear majority of Medicare enrollees with incomes below the federal poverty threshold are not enrolled in Medicaid (although in 14 states there are some drug benefits for low income non-Medicaid seniors).

these programs very briefly. [2,3] Unfortunately the nature of the programs, the timing of their introduction and adjustment, and particularly the available data do not yield ideal conditions for the analysis of a "natural experiment". Nonetheless in this study we use the existing information to draw some conclusions as to how these programs have affected out-of-pocket expenditure. In brief we will conclude that if we accept a first-order approximation that will be accurate if price responses are small (a position that is consistent with published empirical findings), the evidence is that from a purely redistributional perspective, prescription drug subsidies were less beneficial to low income households than if the same dollars had been put into a program of fixed cash transfers, paid equally to all households, regardless of income. However the subsidies were probably mildly more beneficial to low income households than an equal-valued cash transfer set equal to a fixed percentage of income. Hence there appears to be no strong support for such plans *solely on income distribution grounds*.

We recognize that prescription drug subsidies could improve (or worsen) market efficiency. For example, adverse selection might result in coverage being denied to those willing and able to pay for it and public drug coverage could resolve this. Subsidies might also encourage the use of pharmaceuticals which substitute for other more costly forms of

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[2]For further information, see Grootendorst (1999). Note that before 1970, British Columbia (B.C.) had a program available for low income seniors and in other provinces, some seniors may have acquired prescription drugs though social assistance programs.

[3]Canada provides an interesting source of evidence on the potential effects of various expansions of public health insurance that might be considered in the U.S. Not only does Canada have much more extensive public insurance, but elements of public insurance were introduced in a staggered way across provinces providing a number of "natural experiments". For example, Gruber and Hanratty (1995) use the introduction of National Health Insurance in Canada to study the disemployment effects of such schemes.

publicly funded health care, such as hospitalizations. Finally, a public drug plan may change the supply price of drugs. In particular it is sometimes argued that such a plan may provide prescription drugs at a lower unit cost through the introduction of some degree of market power in the public purchase of drugs (perhaps offsetting monopolistic power held by pharmaceutical drug producers).[4,5] However the family expenditure data set we employ is not informative on these issues because we do not know the actual drugs or their prices, only total household expenditure on prescription drugs. While efficiency aspects may well be important, the motivation behind the proposed pharmaceutical drug plans clearly includes distributional issues, and hence it may be useful to investigate the Canadian experience from that perspective.

The basic approach and the data are described in Sections 2 and 3 respectively. Section 4 examines the distribution of out-of-pocket expenditures on prescription drugs using descriptive statistics and applied econometric techniques. The latter include semiparametric regressions that allow for a very flexible relationship between expenditures and income while controlling for the influence of gender, age, region, marital status and household size in a tractable way. Section 5 concludes.

2. The Approach

The "textbook" analysis of the incidence of a commodity subsidy proceeds as follows.

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[4]See Peabody, Bickel and Lawson (1996) for some evidence of the effects on price of a national prescription drug purchasing body in Australia.

[5]A reduction in supply price may reduce research and development expenditure, although not necessarily in the jurisdiction of the drug plan.

Suppose each household *h* of H households has an indirect utility function:

$$v_h = v(x_h, p, z_h) \tag{1}$$

where x_h is total outlay, p is a vector of prices and z_h is a vector of household characteristics.[6] Then by Roy's Identity, the effect of an increase in p_i is:

$$\partial v_h / \partial p_i = -q_i(\partial v_h / \partial x_h) \tag{2}$$

or, in terms of percentage changes in prices:

$$\partial v_h / \partial \ln p_i = -p_i q_i(\partial v_h / \partial \ln x_h)/x_h = -\grave{u}_{ih}\, \partial v_h / \partial \ln x_h \tag{3}$$

where $\grave{u}_{ih}$ is the expenditure share for commodity *i* of household *h*. This is just one formal way of capturing the notion that if a program reduces incrementally the price paid for commodity *i*, the gain to a household depends upon how much that household is currently spending on that commodity. A direct implication of (2) is that if the total government outlay on the commodity subsidy to all households is \$1 and we compare this to the alternative of a program which divides the \$1 up equally so that each household receives a cash transfer of \$1/*H* (that is each household's budget increases by the same *absolute* amount), a household will prefer the commodity subsidy if and only if its *absolute expenditure* on the commodity is above the household average. Similarly (3) implies that if the alternative program is a cash transfer that increases each household's income by the same *percentage* amount[7], a household will prefer the

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[6]Our use of total outlay can be motivated by a two stage (*inter*-temporal, followed by *intra*-temporal) budgeting model, or more loosely by the observation that total outlay (from which we exclude purchases of cars and recreational vehicles) is closer to "permanent income" than is current income. In what follows, we use the terms "high outlay" and "low outlay" interchangeably with "high income" and "low income" respectively.

[7]Some tax cuts might in some instances approximate such a program.

commodity subsidy if and only if its *expenditure share* on the commodity is above average.[8]

A policy might be supported on pure income distribution grounds if it is more redistributive than a cash transfer (i.e. if it is preferred to a cash transfer by those with low incomes). We call such a policy *progressive*. Keeping with the textbook analysis, an incremental commodity subsidy might therefore be thought of as progressive if absolute dollar expenditure on that commodity falls with income (the subsidy represents a greater dollar saving to households of low means than to those of high means) or, more weakly, if that commodity's budget share falls with income (the subsidy constitutes a greater percentage budgetary saving for households of low means than for those of high means). Hence those who favor redistribution tend to favor, all other things equal, subsidizing more and taxing less those commodities whose consumption, measured absolutely or as a budget share, tends to fall with income. This suggests that an examination of how out-of-pocket prescription drug expenses vary with income can be an important component of an analysis of the distributional impact of a public drug plan. We begin our analysis in this way, using simple descriptive statistics as well as semiparametric regression techniques (described below) to characterize the relationship of the household's budget share of pharmaceutical drugs to total household outlay (that is, Engel curves).

One well known problem with the textbook analysis of incidence outlined above is that it is a first-order approximation and thus is only really appropriate for infinitesimal price

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[8]Note that even though the utility gains in (2) and (3) depend upon the household's marginal utility of income, which may not be comparable across households, the value of the marginal utility of income does not affect a single household's preference between an incremental commodity subsidy and a cash transfer.

changes. Policies of the type we are interested in involve discrete and substantial price changes. Knowledge of the price elasticities of the commodity in question allows for a more accurate second-order approximation, and, in principle, estimation of a complete demand system allows for the calculation of exact welfare changes. (See Banks, Blundell and Lewbel (1996) for a recent discussion of these alternatives.)

Unfortunately, our data are not well suited to the estimation of price elasticities for prescription drugs. In his review of the U.K. and U.S. literature, Hurley (1990) notes that most estimates of the price elasticity of drug use are very small (-0.1 to -0.2), although typically the copayments examined have been modest. One important study is Leibowitz, Manning and Newhouse (1985) who found elasticities in this range for the Rand randomized-controlled trial of drug copayments applied to non-Medicaid and non-senior U.S. trial participants. Research directly on the copayments introduced into Canadian provincial prescription drug plans for seniors (as described in Table 1) has largely confirmed these findings: three published studies (Grootendorst, O'Brien and Anderson, 1997; Poirier *et al*, 1998 and Hux and Fielding, 1997) and two unpublished studies for Nova Scotia and British Columbia all find very small price responses, although one other study (Grootendorst, 1997) finds substantial price responses for low income single males in British Columbia. Of recent U.S. studies, perhaps the most relevant is that of Johnson *et al* (1997) who estimate an elasticity of -0.13 for low income elderly HMO beneficiaries while Smith (1993) and Harris, Stergachis and Ried (1990) estimate elasticities of even smaller magnitude for an employment related drug plan and a HMO respectively. The

smaller price elasticities are, the better first-order approximations may be expected to perform.[9] Thus much of our interpretation will proceed on the assumption that the first order approximation suffices. We will revisit the issue in our concluding section.

In the context of a prescription drug subsidy, there are a number of other reasons why the textbook analysis may be inappropriate. First, a nontrivial number of households have no prescription drug expenditures. An incremental price reduction will provide no utility gain to those who use zero prescription drugs (because they still will use zero after the price change) but a discrete price reduction may induce usage and hence "zero users" require special consideration.

Second, many of the observed (and most of the proposed) prescription drug subsidy plans feature user charges, including fixed fee copayments, and sometimes deductibles and other

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[9]Our settling for a first order approximation also bypasses another complication. If we do take a second order approximation by differentiating (3) again with respect to log price, the result will involve not only the price elasticity of demand but the product of budget share and the derivative of marginal utility of income with respect to log price. The approximation error from omitting this second component of the second term of the expansion will therefore be smaller the smaller is budget share, and the average budget share of prescription drugs is small. Nevertheless, a second order approximation that used price elasticities but did not also specify this additional derivative would be incomplete, because assuming price independence of the marginal utility of income is a strong restriction on preferences. To see this, recall that the indirect utility function is homogeneous of degree zero in income and prices, so that, by the derivative property of homogeneous functions, the marginal utility of income must be homogenous of degree minus one in income and prices. If the marginal utility of income is independent of prices, then it must be homogenous of degree minus one in income alone. The only such function is $\partial v/\partial x = k/x$, where k is a constant. Integrating, and allowing the constant of integration to depend on prices, gives $v = k*ln(x) + á(p)$, which is an indirect utility function corresponding to homothetic preferences (for further details, see Theorem 1 and the associated discussion in Banks, Blundell and Lewbel (1996)). Homotheticity is very restrictive, and implies that budget shares are independent of income - goods are neither necessities nor luxuries. Thus assuming price independence of marginal utilities amounts to an assumption which makes estimation of Engel curves unnecessary.

provisions as well. This means that the subsidy varies with drug consumption and in some cases, income; a kinked budget constraint again invalidates the standard analysis.

Furthermore, it may be that individuals of different economic circumstances have different probabilities of using nonformulary prescription drugs,[10] have different numbers of uninsured individuals in their households or have different degrees of success in gaining financial benefit from the plan.[11] Finally, we note that the presence of a public prescription drug plan may also affect prescriber behaviour or the interaction between patient and prescriber, or the interaction between insurers and the insured in different ways for patients of different means.[12]

For the reasons just listed, we extend our analysis beyond the Engel curve characterization prescribed by the textbook analysis to examine the out-of-pocket expenditures on prescriptions by various income groups before and after the implementation of actual plans. Suppose for example that the introduction of a drug subsidy coincided with a larger fall in prescription drug expenditure for low income households than high income households. Under the maintained assumption that price responses are negligible, this would indicate that the policy change was more progressive (in the sense described above) than equal public expenditure on a

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[10]Most of the prescription drug plans have formularies that do not include all possible drugs, although sometimes there is a very good formulary substitute for a nonformulary item.

[11]In some cases exploiting program benefits may require keeping track of copayments (in cases where there is a maximum out-of-pocket) or keeping track of individual expenditures because of a cumulative deductible.

[12]For example it may be that individuals of different means may be more or less aggressive with the prescriber, or prescribers may be more likely to prescribe if they know patients are more able to afford any out-of-pocket cost. Alternatively, either patient or prescriber behaviour may vary with the insurance status of the patient, and that in turn may vary with income.

per household absolute cash transfer. Similarly if the *percentage point* fall in the budget shares of out-of-pocket prescription drug expenditures was larger among low income households than among high income households, the policy change would be described as more progressive than a cash transfer that increased each household's budget by the same percentage.

This further analysis is informative about a world that is richer than the textbook model allows, and in which some or all of the kinds of effects listed above may be important. By examining the data before and after the implementation of actual plans, we can roughly capture these other kinds of effects by studying the actual rather than the projected (or counter-factual) changes in out-of-pocket expenditure.

3. Data

The Canadian Family Expenditure (or FAMEX) data is a series of cross sectional surveys conducted by Statistics Canada at irregular multi-year intervals from 1969 to 1996. Lower population regions such as the Atlantic provinces are over-sampled. Surveys are taken from household members by personal interview; income is reconciled with expenditure and saving. We choose the 1969, 1974, 1984, 1986, 1990, 1992 and 1996 surveys as these data sets contain prescription drug expenditure information.[13] We then limit the sample in all years to respondents in 15 urban centers as the surveys were limited to these centers in 1974, 1984 and 1990. We convert all dollar values into 1992 dollars using the Consumer Price Index.[14]

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[13]There were also FAMEX surveys in 1978 and 1982 but the resulting data releases did not contain information on pharmaceutical expenditures.

[14]In 1992, C$1=US$.83. Currently C$1=US$.69.

Table 2 summarizes some of the important national trends for seniors (households with head of age 65 or over and spouse, if present, also of age 65 or over) and, by way of comparison, for nonsenior (or "working age") households.[15]

Table 2 shows that for both senior and nonsenior households, out-of-pocket household prescription drug expenditures were relatively small in 1969 (less than $250). For both seniors and nonseniors, prescription drug expenditures fell to less than $100 by 1984 and then rose more recently, more sharply for seniors than for others but still less than 1969 levels. Note that prescription drug costs are only about a quarter of all out-of-pocket medical expenditures (including eyeglasses, hearing aids and dentistry) for nonsenior households and about a third for seniors.

Table 2 reveals that senior households spend more on prescription drugs than nonsenior households *absolutely*; this is also true as a proportion of total outlay. For example, in 1996 the budget share of out-of-pocket spending on prescription drugs was 1.4% for senior households and 0.5% for nonsenior households.[16] A reader might conclude that this fact, along with the fact that seniors are on average a low income group, constitutes a redistributive argument for prescription drug plans for seniors. We would argue against this conclusion. Seniors are an easily identified group and thus can be targeted with the type of straight cash transfers we have discussed. Thus any redistributive argument for a prescription drug plan for seniors must rest on

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[15]The Canadian income tax system does provide some relief for large medical expenses, in effect paying about 25% of expenses in excess of about $1,600. This relief diminishes if the individual or her/his spouse has income for tax purposes in excess of about $50,000. Figures for medical expenditures below do not include this income tax relief.

[16]The budget share of out-of-pocket prescription drug expenditures is larger among senior households than among working age households in every year for which we have data.

how progressively such a plan targets assistance *within* the population of senior households. Thus our subsequent analysis focuses exclusively on expenditure patterns and changes in expenditure patterns within the senior population.

Figure 1 displays a scatter plot of budget shares against the logarithm of total outlay for senior households drawn from the years 1969, 1986, and 1996. Several features of the data are immediately apparent, including a substantial fraction of zeros, and a small group of very large budget shares (budget shares greater than 15% are labeled by the year in which they occurred.) We now turn to an investigation of these expenditure patterns.

4. Results

4.1 Semiparametric Engel Curves

We begin our analysis of the incidence of such prescription drug subsidies by characterizing the relationship between the budget share of out-of-pocket prescription drugs and income (or total outlay). We do so in a multivariate framework. This is an attempt to isolate the relationship between such expenditures and income from other determinants of demand such as household size and other demographics. Because a general *nonparametric* model for prescription drug share for household *h*

$$\grave{u}_h = f(ln\ x_h, z_h) + \mathring{a}_h \tag{4}$$

would have too many dimensions and be infeasible to estimate and interpret, we instead posit a *semiparametric* model

$$\grave{u}_h = g(ln\ x_h) + z_h\hat{a} + \mathring{a}_h, \tag{5}$$

that is, we allow the expenditure share ($\grave{u}_h$) to be a flexible function of the log of total income

($ln\ x_h$) but restrict the household attributes (z_h) to affect the share in the linearly additive way assumed for standard linear regression analysis. This "hybrid" approach allows us to keep the dimensionality of the model down but still allow a detailed analysis of the relationship of prescription drug expenditure share to income.

There are at least two methods to estimate models such as (5) discussed in the literature. Blundell and Duncan (1998) discuss a method due to Robinson (1988) which is fully efficient. We first estimated the models discussed here using this method and also performed the test they propose (p. 78) of the null hypothesis that $ln\ x_h$ is exogenous; the null hypothesis was not rejected. However, we also tried the "differencing" method discussed by Yatchew (1998). This method is not fully efficient in a statistical sense but is much more rapid computationally and in the cases where both methods were tried, produced estimates which were very similar to those produced by the Robinson method. The following results use this differencing method.

Table 3 gives the coefficients (the estimates of â in (5)) corresponding to various household attributes. The first column corresponds to the older population in 1969 (before almost all the public plans for seniors were available), the second column reports results for 1986 (when the programs were perhaps at the peak of their generosity[17]) and the third column presents estimates for 1996.[18]

The coefficients are multiplied by one hundred, so that they should be read as

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[17]The beginning of retrenchment was perhaps marked by the introduction of copayments by British Columbia in 1987. Subsequent cutbacks by other provinces are described in Table 1.

[18]Quebec, New Brunswick and Nova Scotia have charged prescription drug plan premiums to seniors since the 1990s but we have omitted these from this analysis, partly because except for Nova Scotia after September, 1996 where explicit opt-out provisions were introduced, it is difficult to distinguish a "premium" from a tax.

percentage points. Thus the budget share of prescription drugs was more than one percentage point higher for married senior households than unmarried in 1969, and this gap was statistically significant. In 1986 there was no significant gap, while in 1996 the gap was significant again, with the budget share of married households almost a percentage point higher than for unmarried households.

There are no significant effects of gender or household size. The latter may reflect the fact that among the senior population most of the variation in household size is between one and two person households and this variation is largely captured by the "married" dummy variable. There are significant regional effects, and they vary across years. We return to this in the next section.

More relevant for the textbook analysis is Figure 2, which plots, for each of the three years noted above, estimates of $g(\ln x_h)$, the relationship of the out-of-pocket budget share of prescription drugs to income. (Of course the nonparametric portion cannot be condensed to a vector of coefficients and must be represented graphically.) It can be seen that, conditional upon the variables in Table 3, the relationship has a downward slope, indicating that expenditure share falls with income in each year. This suggests that a prescription drug subsidy may provide a greater benefit to low income senior households. Note, however, that the slopes are not very steep as the horizontal scale is in logarithms of total outlay. The relationship between budget shares and the logarithm of income is roughly linear in each year, particularly the most recent two.

Figure 2 does reveal interesting differences between the years. Across almost the whole range of total outlay, budget shares fall from 1969 to 1986 and then rise again by 1996 (though

not to 1969 levels).[19] It also appears that the relationship between the budget share of out-of-pocket prescription expenditures and income flattened after 1969. In the next section, we investigate these changes across time, and decompose them by region.

4.2 Data by Region Through Time

Following the outline of Section 3, we now consider changes in the pattern of out-of-pocket prescription drug expenditures by region and through time. The FAMEX groups the provinces of Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick as the Atlantic region and Manitoba, Saskatchewan and Alberta as the Prairie region. (Hence some cross-provincial variation is unobservable.) However, the provinces of British Columbia, Ontario and Quebec each comprise their own region. Because the regional samples are smaller, we concentrate on simple descriptive statistics (and supporting regression analysis) as opposed to the nonparametric analysis of the previous section. Table 4 provides, by region, mean real out-of-pocket prescription drug expenditure, budget share and percentage of zero purchasers for high income and low income senior households (top 25% and bottom 25% by outlay).

The overall trend through time is as was suggested by Figure 2. Between 1969 and 1986 as more subsidies were introduced, the fall in absolute prescription drug expenditures and budget shares was sharp for both high income and low income senior households for almost all regions. However, as provinces moved towards higher copayments and deductibles in the late 1980s and the 1990s, this fall was reversed, particularly for high income seniors. This reversal

[19] The predicted budget shares in Figure 2 are constructed to have the same mean as the actual budget shares in each year by adding back the (yearly) mean of $z_h\hat{a}$.

may also reflect the great increase in the variety and cost of available pharmaceutical drugs.

The effects of the provincial programs are reasonably clear in the regional data. It appears that the Atlantic provincial programs (introduced in Nova Scotia in late 1974 and in New Brunswick and Newfoundland between 1974 and 1984) had some impact in reducing out-of-pocket costs between 1974 and 1984 and there was a further reduction by 1986 as the smallest province of Prince Edward Island also introduced a program. The effect of increasing copayments is also evident in the more recent increases in out-of-pocket expenditures, especially among high income seniors. The trend in expenditures data for Quebec is consistent with the staggered introduction of a no-cost-sharing plan for low income seniors in August, 1974 and then for all seniors in October, 1977. There are also evident effects of copayments introduced for high income seniors during 1992 and for all seniors during 1996. Similarly, the effect of a no-cost-sharing program introduced in Ontario late in 1974 (initially only for low-income seniors but by 1975 for all seniors) is clear as is the introduction of income-contingent copayments half way through 1996. British Columbia displays a similar pattern as a full cost sharing program for all seniors was introduced at the beginning of 1974 and copayments were introduced in 1987 and increased in 1994.

Two of the three Prairie provinces had substantial percentage copayments in their initial programs, and out-of-pocket prescription drug expenditures fell only for high income households between 1969 and 1986 while they actually increased for low income households. We will discuss this further below. The reduction in generosity of the programs in all three Prairie provinces during the late 1980s and the 1990s has tended to increase expenditures for both low and high income households.

To interpret these data in terms of distributive effects, first consider the situation in 1969. High income seniors spend considerably more on drugs than low income seniors in absolute terms, although high income seniors also have a smaller budget share except in B.C where there was already in 1969 a public program available for low income seniors. Hence under the maintained assumption of negligible price response, it would have been predicted that a drug subsidy would have been less progressive than a per household cash transfer to seniors but more progressive than a percentage-of-budget transfer. The experience for the period from 1969 to 1986 (from almost no subsidies to peak generosity) is largely consistent with this prediction: absolute dollar expenditure reductions in all regions were higher for high income households. In most regions, budget shares fell more for low income households (for example in Quebec, a fall of 2.1 percentage points from .025 to .004 for low income households but 1.3 percentage points from .015 to .002 for high income households). But the case of the Prairies is striking. There, out-of-pocket prescription drug expenditures decreased for high-income households between 1969 and 1986, both in absolute dollars and as a budget share, but *increased* for low income households. It seems clear that the reason is the higher copayments in the Prairie provinces, particularly in Manitoba and Alberta. That is, an increase in usage by low income households on the Prairies led to increased expenditures because of the substantial copayments, whereas any increase in usage in other jurisdictions was insufficient to increase expenditures, given the smaller copayments. The increase in usage by Prairie low income households could be a price response to the subsidy (the subsidization increasing usage between 1969 and 1986) and hence falsify our maintained assumption. However it could also be the consequence of one or more other factors, including increased demand for pharmaceuticals over

that period as new and more expensive drugs were developed.

Between 1986 and 1996, the increases in copayments and deductibles were associated with larger prescription drug expenditure increases by high income households than low income households. In B.C., the introduction of universal deductibles predictably led to larger budget share increases for low income seniors than for high income seniors. But overall the pattern is consistent with Figure 2: between 1986 and 1996, the prescription drug budget share seems to increase by approximately the same amount, regardless of income. This seems to suggest that the incidence of the copayments and deductibles was not adversely redistributive, although this is no doubt in part due to the fact that some of these provisions were income-contingent as described in Table 1.

As mentioned, we also conducted a regional regression analysis of budget share although for brevity we will just summarize the results. The nonparametric model used earlier was followed except (again due to the smaller regional samples) the logarithm of income was entered linearly rather than nonparametrically and all the yearly data were pooled for each region, with only a different intercept and log income coefficient for each year. The essential conclusion from both OLS and Tobit regressions was that between 1969 and 1986, prescription drug programs only clearly flattened the downward-sloping Engel curve (that is appeared to reduce budget share more for low income than for high income households) in Ontario and in Quebec (although the effect had diminished by 1996), with some weaker evidence of a similar effect in the Atlantic region. The estimated Engel curve steepened to some extent in B.C. and substantially in the Prairies over this period, consistent with the results in Table 4. Estimated changes in the Engel curve slope between 1986 and 1996 were mixed and tended to be small.

The data on the percentage of zeroes is difficult to interpret because a zero-user could be either (a) a household with no need of prescription drugs (would not purchase at any income or any set of prices), (b) a household that receives all or virtually all of its prescription drugs at the expense of a prescription drug plan, private or public (faces a price for prescription drugs of essentially zero) or (c) a household in which there are health problems that would normally require prescription drugs but does not purchase them because of cost (that is, a corner solution: the household would purchase at different prices or income). We do note, however, that by the end of 1996 no provincial prescription drug plan offered 100% first dollar coverage to either high or low income groups and in each case there are more zero-users among those with low-income. This suggests that low-income individuals are less likely to use the public plan. It seems unlikely that this is because of superior health status, or greater coverage by private plans and hence it seems likely that some of this is a reaction to copayments. This is again some evidence in contradiction to our maintained assumption of negligible price responses.

4.3 Large Users and Insurance

The reader will have noticed the "spray" of large users in Figure 1, suggesting that there are some seniors with a very large budget share spent on prescription drugs. Our samples are not large enough to capture enough large users for a detailed empirical analysis. While not conclusive because of sample size, we can make the following observations. First, most of the large budget shares occur in 1969 (before the introduction of any drug plans for seniors) and 1996 (after the introduction of many copayments and deductables) while almost none are

observed in 1986 (when the plans were at their most generous). Second, most 1996 large users were in the Prairie region where copayments are the highest. We perhaps should re-emphasize that among the efficiency arguments for prescription drug plans, one is to remedy an insurance market failure due to adverse selection. It seems to us, however, that such an argument is strongest for plans with out-of-pocket maximums that are income contingent and does not by itself support plans which subsidize even small users.

Finally, Table 5 considers private plan health insurance expenditures. We cannot determine what portion of these plans include prescription drug coverage, although it is clear some per user expenditures are extremely small and may be simply travel medical insurance or some other sort of small policy. By law, private insurance cannot cover 'medically necessary' hospital and physicians' services which are provided to Canadians through their provincial health insurance programs. Private plans cover items such as prescription drugs, dental care, eyeglasses, hearing aids, prosthetics, semiprivate and private hospital rooms as well as services provided by non-physician personnel (such as chiropractors and physiotherapists). While we cannot determine the exact fraction of these plans which include prescription drug coverage, industry information (Canadian Life and Health Insurance Association, 1994) suggests that between 87% - 95% of private health insurance policy holders have coverage for prescription medicines. It is clear that high income individuals pay more on average for such insurance but there seems to be no relationship by region, i.e. the Atlantic and Prairie regions both have relatively high per user prescription drug expenditures but only the former has much higher insurance expenditures; both Quebec and British Columbia are relatively low in both respects while Ontario has relatively low prescription drug expenditures but is about in the middle in

terms of insurance costs. As health insurance plans typically take advantage of existing government coverage and in that way increases the usage of public provisions, our conjecture is that the differential in insurance expenditures by income if anything suggests higher utilization by higher income households than our previous analysis suggests (and hence less redistributive benefit from prescription drug subsidies).

5. Discussion

In this paper we have reported evidence on the incidence by income of out-of-pocket medical costs and prescription drug expenditures by Canadian senior households over the period 1969 to 1996. Our focus has been on the question of the likely redistributional effects of prescription drug plans, particularly in light of United States proposals for prescription drug plans for the older population. All Canadian provinces have both introduced and modified drug plans for seniors during this period.

The first stage of our analysis confirms that throughout the period, absolute dollar expenditures on prescription drugs have been higher for households with higher incomes while the relationship between prescription drug budget shares and income is negative among seniors, though not strongly so. Thus what we have labeled in Section 2 the textbook analysis (which is based on a first-order approximation that assumes price responses are negligible, a position that is not sharply inconsistent with published empirical findings) would conclude that the incidence of a prescription drug subsidy for seniors is less progressive than a per household cash transfer but more progressive than a percentage-of-income cash transfer, though only mildly so.

This textbook analysis involves a counterfactual statement which may be invalidated by

either the nature of the subsidies under consideration (many include deductibles or copayments with maximums, and so are not a proportional price adjustment) or by the way in which expenditures on prescriptions drugs are determined (involving a patient - prescriber interaction, for example). Thus we have examined how the pattern of out-of-pocket prescription drug expenditures has varied across regions and through time as Canada's provincial governments introduced and modified prescription drug plans for the older population.

We conclude that the introduction of a prescription drug plan changes the relationship between out-of-pocket prescription drug expenditures and income, and the changes are very different across plans. The introduction of a subsidy tends to reduce absolute prescription drug expenditures much more for high income individuals than for low income individuals, although low income individuals typically have a greater reduction in budget share. The key exception is the Prairie region between 1969 and 1986. The evidence, while incomplete, suggests on balance (as the textbook analysis did) that prescription drug subsidies would be dominated on income distribution grounds by a fixed per household transfer program of equal cost and would not strongly dominate a program of equal cost featuring cash transfers equal to a fixed percentage of a household's income.

As noted, both stages of our analysis rest on the assumption that price responses of out-of-pocket prescription drug expenditures are small. This assumption is consistent with the findings of most existing empirical studies (as discussed in Section 2), although Grootendorst (1997) is one recent study which estimates a large response (for low income single males in British Columbia). Were price elasticities of prescription drug demand substantial, our analysis would be more difficult to interpret. For example, if a subsidy were to cause a substantial

increase in prescription drug expenditures among low income individuals via a price response, but not among high income users, then a progressive policy might appear regressive by our criteria. This highlights the fact that the price elasticities of low income individuals may be particularly pertinent in a distributional analysis.

Our data set is not well suited to an examination of price elasticities among different income groups. The principal difficulty is that we observe only total expenditures on all prescription drugs and not quantities or individual prices. However, two features of our data are suggestive of price responses. First, the introduction of prescription drug subsidies with significant copayments in the Prairie region between 1969 and 1986 led high income individuals to reduce their prescription drug expenditure and budget share while both expenditure and budget share increased for low income individuals. One possibility is that this is a price effect but there are other possibilities, including a combination of effects including an increase in demand for pharmaceutical drugs over this period. Second, in all regions there appeared to be fewer zero users among higher income households (which again is open to several interpretations).

If low income households are more price responsive it suggests our analysis may at least somewhat understate the redistributive benefits of prescription drug subsidies. However, our reading of the data is that the price elasticities would have to be quite large and quite different by income groups to build any kind of redistributional case for the introduction (in the United States, for example) of a prescription drug subsidy for seniors over a fixed equal cash transfer. And if an incremental increase in the extant Canadian subsidies were introduced in 1996, it is clear that one reason low income households might benefit less than high income households is

that there are more zero users among low income households and a zero user does not benefit from an incremental subsidy.

Finally, we note as we did in the introduction that there are a number of efficiency arguments that may be part of the case for prescription drug assistance. Our analysis so far suggests that, until and unless new evidence of substantial price elasticities for prescription drugs among low income seniors is documented, the case for public prescription drug plans for seniors should probably stand or fall on those efficiency considerations.

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Table 1
Brief Summary of Prescription Drug Subsidy Programs for Seniors by Province, Canada

Province	Intro-duction	Brief Description
Newfoundland	Apr. 1980	Only low-income seniors covered, copayment = dispensing fee (typical value, $7.61 in 1992) + 10% of ingredient cost if > $30.
Prince Edward Island	Jan. 1986	Fixed copayment per prescription (e.g. $11.85 in 1992, $15.45 in 1999).
Nova Scotia	Oct. 1974	Initially no copayment; June, 1990: fixed copayment $3 per prescription; since June 1991 copayment = 20% of cost (min. $3) with various maximums (e.g. $150 in 1992), sometimes income-contingent; since April 1995 income-contingent premiums up to $215/yr. (opt-out provision since Sept. 1996).
New Brunswick	Jan. 1975	Initially no copayment; since Nov. 1983 fixed copayment per prescription (e.g. $7.05 in 1992, $9.05 in 1999) to annual maximum for all seniors, initially $30, raised to $45 (Jan. 1985); since Jan. 1988, maximum only allowed for lowest income seniors and raised to $120 ($250 in April, 1996); since July, 1992, premium for high-income seniors (e.g. $48/month in 1992).
Quebec	Aug. 1974	Initially no copayment, although first 2 years for low income seniors only, then for all seniors (Oct. 1977); May 1992: copayment (except for low income seniors) of $2 per prescription to annual maximum of $100; since August, 1996: 25% copayment up to various income-contingent maximums (deductibles and income contingent premiums since Jan.1997).
Ontario	Sept. 1974	Initially no copayment, although first year for low income seniors only, then for all seniors; since July, 1996: $2 per prescription for low income seniors; others pay $6.11 per prescription above $100 deductible.
Manitoba	July 1973	20% copayment and deductible (e.g. $106.60 in 1992); January, 1993: copayment increased to 30%; beginning April 1996 zero copayment with income-contingent deductible (2%-3% of household income).
Saskatchewan	Sept. 1975	Initially fixed $2 copayment which increased to $3.95 by June 1987; since July 1987: copayment = 20%, then 25% (March, 1991), then 35% (May, 1992) plus deductibles (initially family $75/yr, single $50/yr but since March 1993 semi-annual $100 for low income senior, $850 for high-income senior); since March, 1993 semi-annual out-of-pocket limit of 1.7% of adjusted household income up to $50,000.
Alberta	July 1970	copayment = 20%, min[30%,$25] since June 1994, no premium since Jan. 1972
British Columbia	Jan. 1959	Coverage for some low income seniors since 1959 (e.g. July 1972 $2 copayment plus 50% of balance); July, 1973: program for all seniors, no-cost sharing; April, 1987: copayment = 75% of dispensing fee to $125 annual maximum; since April, 1994: copayment = 100% of dispensing fee to $200 annual maximum

Table 2
Mean Real Out-of-Pocket Direct Medical Expenditures, Nonsenior and Senior Households, Canada, 1969-1996

	Direct Medical Expenditures (excluding insurance)		Prescription Drugs	
	Nonseniors	**Seniors**	**Nonseniors**	**Seniors**
1969	$813	$620	$201	$228
1974	$597	$420	$139	$172
1984	$557	$399	$94	$78
1986	$547	$451	$91	$71
1990	$594	$561	$113	$129
1992	$615	$570	$129	$158
1996	$636	$712	$141	$222

All values deflated to 1992 dollars using CPI.

Table 3
Coefficients from Semiparametric Regression
With Prescription Drug Expendiure Share Variable as Dependent Variable and Log of Total Expenditure as "Nonparametric Variable"

	1969	1986	1996
Variable	Coefficients ($\times 10^{-2}$)		
Female (=1 if female)	2.262	-1.517	-1.563
	[.77]	[-1.04]	[-.87]
Married (= 1 if Married)	1.360	-0.283	0.858
	[3.96]	[-1.21]	[3.5]
Age (household head)	0.055	0.001	0.008
	[2.05]	[.07]	[.43]
Age*Female	-0.022	0.024	0.028
	[-.55]	[1.23]	[1.15]
ln(Household size)	-0.453	1.052	-0.729
	[-.63]	[2.09]	[-1.16]
ln(Household size) squared	-0.050	-0.324	0.881
	[-.1]	[-.88]	[1.74]
Atlantic province (=1, 0 otherwise)	1.283	0.593	1.297
	[3.75]	[3.8]	[7.42]
Quebec (=1, 0 otherwise)	0.796	0.037	0.592
	[2.52]	[.24]	[2.94]
Prairie province (=1, 0 otherwise)	0.325	0.801	1.975
	[1.15]	[6.02]	[11.71]
BC (=1, 0 otherwise)	-0.536	0.028	0.370
	[-1.71]	[.18]	[2.01]
Constant	0.001	0.000	-0.001
	[.01]	[0]	[-.01]
Number of Observations	757	788	1493
R^2	0.07	0.09	0.12

Notes:
1. T-statistics in brackets.

Table 4
Real Out-of-Pocket Prescription Drug Expenditures: Mean, Budget Share and Percentage of Zeroes, Seniors, High Income and Low Income Groups, by Region, Canada, 1969-1996

	Atlantic		Quebec		Ontario		Prairies		B.C.	
	High	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**
1969	$354 (.015) 22%	$159 (.027) 46%	$368 (.015) 39%	$159 (.025) 45%	$274 (.012) 24%	$123 (.019) 53%	$265 (.012) 21%	$89 (.013) 53%	$235 (.009) 31%	$32 (.006) 75%
1974	$535 (.025) 19%	$170 (.023) 56%	$308 (014) 24%	$91 (.013) 55%	$247 (.010) 22%	$64 (.009) 53%	$176 (.008) 38%	$120 (.017) 39%	$7 (.000) 87%	$4 (.000) 94%
1984	$203 (.008) 50%	$124 (.017) 43%	$115 (.004) 35%	$14 (.002) 74%	$26 (.001) 75%	$0 (.000) 100%	$118 (.005) 20%	$109 (.014) 28%	$51 (.002) 81%	$14 (.001) 88%
1986	$129 (.005) 50%	$76 (.008) 53%	$51 (.002) 61%	$34 (.004) 76%	$54 (.001) 67%	$6 (.001) 93%	$139 (.005) 22%	$139 (.018) 25%	$8 (.000) 89%	$7 (.001) 87%
1990	$150 (.006) 30%	$205 (.024) 40%	$243 (.009) 68%	$51 (.007) 81%	$66 (.003) 74%	$7 (.001) 96%	$253 (.008) 20%	$179 (.021) 23%	$63 (.002) 33%	$41 (.005) 50%
1992	$191 (.007) 35%	$208 (.023) 28%	$129 (.004) 27%	$29 (.003) 50%	$60 (.002) 80%	$10 (.001) 84%	$382 (.015) 21%	$208 (.024) 35%	$80 (.003) 33%	$58 (.007) 39%
1996	$454 (.017) 15%	$172 (.020) 23%	$240 (.009) 19%	$124 (.013) 31%	$192 (.006) 26%	$34 (.004) 49%	$515 (.018) 12%	$264 (.030) 33%	$129 (.005) 21%	$87 (.011) 25%

Notes: The $ value in each cell is mean usage, the value below it in parentheses is the budget share and the % value is the percentage with zero prescription drug expenditure (defined as $5 or less). High income is defined as in the top 25% of total outlay; low income is defined as in the bottom 25% of total outlay.

Table 5
Real Out-of-Pocket Private Health Insurance Expenditures: Means and Percentage Nonzero Incidence, Seniors, High Income and Low Income Groups, by Region, Canada, 1969-1996

	Atlantic		Quebec		Ontario		Prairies		B.C.	
	High	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**
1969	$49 52%	$16 27%	$63 57%	$4 10%	$7 10%	$0 0%	$22 47%	$3 2%	$1 4%	$0 0%
1974	$32 38%	$8 15%	$27 27%	$1 2%	$22 34%	$4 19%	$8 43%	$4 33%	$1 10%	$0 3%
1984	$129 70%	$59 33%	$20 20%	$15 13%	$192 75%	$27 18%	$51 78%	$11 42%	$37 39%	$0 3%
1986	$142 69%	$21 12%	$80 29%	$5 3%	$105 53%	$28 17%	$97 71%	$21 33%	$121 38%	$12 10%
1990	$242 67%	$69 29%	$172 37%	$14 9%	$187 57%	$61 22%	$123 59%	$46 61%	$49 31%	$4 12%
1992	$256 55%	$48 32%	$214 33%	$9 6%	$181 53%	$73 23%	$181 74%	$58 42%	$42 28%	$15 11%
1996	$542 84%	$107 30%	$223 51%	$32 15%	$318 42%	$45 13%	$299 63%	$57 44%	$80 26%	$14 7%

Notes: The $ value in each cell is mean usage and the % value is the percentage with nonzero expenditures. High income is defined as in the top 25% of total outlay; low income is defined as in the bottom 25% of total outlay.

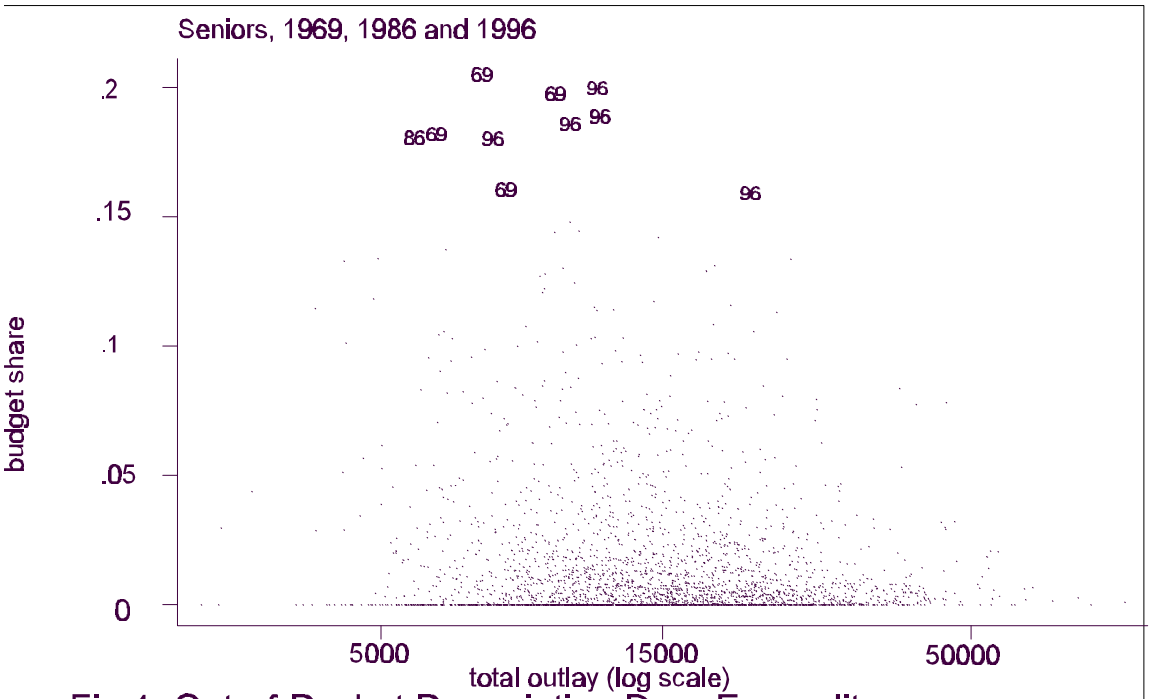

Fig 1: Out-of-Pocket Prescription Drug Expenditures

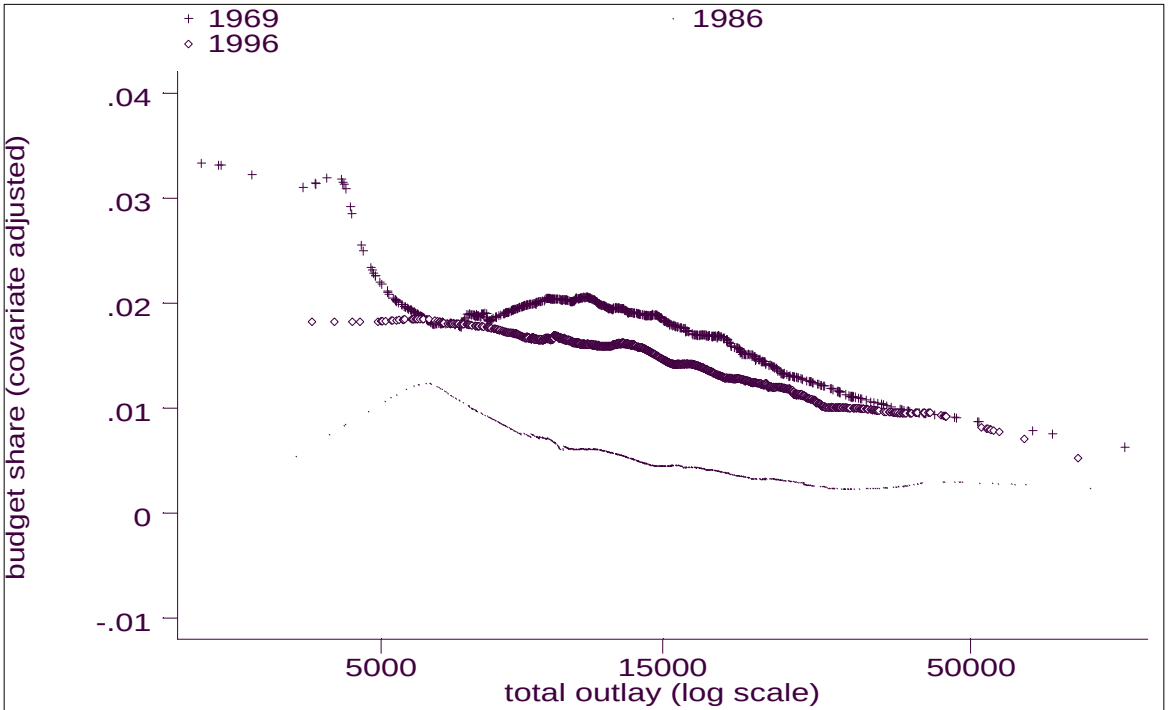

Fig 2: Engel Curves for Prescription Drugs, Seniors

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